

What is claimed is:

1. A micromechanical device comprising a substrate, a movable member overlying the substrate, first and second microactuators carried by the substrate and a coupling assembly for connecting the first and second microactuators to the movable member, the first microactuator moving the movable member in a first substantially linear direction and the second microactuator moving the movable member in a second substantially linear direction substantially perpendicular to the first direction, the coupling assembly including a first linkage coupled to the first microactuator and a second linkage coupled to the second microactuator, each of the first and second linkage having a pivot for permitting the respective linkage to pivot when moving the movable member.

2. A device as in Claim 1 wherein the first linkage extends in a direction parallel to the first direction and the second linkage extends in a direction parallel to the second direction.

3. A device as in Claim 2 wherein the first linkage includes a first flexural member for facilitating bending of at least a portion of the first linkage and the second linkage includes a second flexural member for facilitating bending of at least a portion of the second linkage.

4. A device as in Claim 2 wherein the pivot of the first linkage is part of a first pivot assembly and the pivot of the second linkage is part of a second pivot assembly, the first linkage having a first end portion coupled to the first microactuator by means of the first pivot assembly and the second linkage having a first end portion coupled to the second microactuator by means of the second pivot assembly.

5. A device as in Claim 1 wherein the first linkage includes a first counterbalance for inhibiting undesirable movement of the movable member in the first direction in response to externally applied accelerations to the device.

6. A device as in Claim 5 wherein the second linkage includes a second counterbalance for inhibiting undesirable movement of the movable member in the second

direction in response to externally applied accelerations to the device.

7. A device as in Claim 1 wherein the first linkage includes a first lever member and a first pivot assembly, the pivot of the first linkage being part of the first pivot assembly, the first pivot assembly being coupled to the substrate and the first lever member having a first end portion coupled to the first microactuator and a second end portion coupled to the movable member whereby movement of the first end portion in a third direction opposite to the first direction causes the movable member to move in the first direction.

8. A device as in Claim 7 wherein the second linkage includes a second lever member and a second pivot assembly, the pivot of the second linkage being part of the second pivot assembly, the second pivot assembly being coupled to the first lever member and the second lever member having a first end portion coupled to the second microactuator and a second end portion coupled to the movable member whereby movement of the first end portion in a fourth direction opposite to the second direction causes the movable member to move in the second direction.

9. A device as in Claim 8 wherein the pivot of the second linkage and the pivot of the first linkage are disposed on an imaginary line extending parallel to the second direction.

10. A device as in Claim 1 wherein each of the first and second microactuators is an electrically-driven microactuator.

11. A device as in Claim 10 wherein each of the first and second microactuators is an electrostatic microactuator.

12. A device as in Claim 11 wherein each of the first and second microactuators is a linear electrostatic microactuator.

13. A device as in Claim 1 further comprising an optical element carried by the movable member.

14. A device as in Claim 13 wherein the optical element is a lens.
15. A device as in Claim 13 wherein the optical element is an optical filter.
16. A device as in Claim 13 wherein the optical element is a prism.
17. A device as in Claim 13 wherein the optical element is an optical attenuator.

18. A micromechanical device comprising a substrate, a movable member overlying the substrate, first and second microactuators carried by the substrate and a coupling assembly for connecting the first and second microactuators to the movable member, the first microactuator moving the movable member in a first substantially linear direction and the second microactuator moving the movable member in a second substantially linear direction substantially perpendicular to the first direction, the coupling assembly including at least one counterbalance for inhibiting undesirable movement of the movable member in the first and second directions in response to externally applied accelerations to the device.

19. A device as in Claim 18 wherein the coupling assembly includes a first linkage coupled to the first microactuator and a second linkage coupled the second microactuator, the first linkage having a first counterbalance for inhibiting undesirable movement of the movable member in the first direction in response to externally applied accelerations to the device and the second linkage having a second counterbalance for inhibiting undesirable movement of the movable member in the second direction in response to externally applied accelerations to the device.

20. A device as in Claim 19 wherein the first linkage is provided with a first lever assembly having a first lever member coupled to a first pivot assembly, the first lever member having first and second end portions, the second end portion being coupled to the movable member and first linking means for coupling the first end portion to the first microactuator.

21. A device as in Claim 20 wherein the first linking means has a additional first pivot

assembly coupled to the first microactuator and an additional first lever member coupled to the additional first pivot assembly.

22. A device as in Claim 21 wherein the first linking means has a first flexural member for coupling the additional first lever member to the first end portion of the first lever member.

23. A device as in Claim 20 wherein the second linkage is provided with a second lever assembly having a second lever member coupled to a second pivot assembly, the second lever member having first and second end portions, the second end portion being coupled to the movable member and second linking means for coupling the first end portion to the second microactuator.

24. A device as in Claim 23 wherein the second linking means has an additional second pivot assembly coupled to the second microactuator and an additional second lever member coupled to the additional second pivot assembly.

25. A device as in Claim 24 wherein the second linking means has a second flexural member for coupling the additional second lever member to the first end portion of the second lever member.

26. A device as in Claim 23 wherein the first pivot assembly is coupled between the first lever member and the substrate.

27. A device as in Claim 26 wherein the second pivot assembly is coupled between the second lever member and the first lever member.

28. A micromechanical device comprising a substrate, a movable member overlying the substrate, a first microactuator carried by the substrate and coupled to the movable member for moving the movable member in a first substantially linear direction and a second microactuator carried by the substrate and coupled to the movable member for moving the

5 movable member in a second substantially linear direction substantially perpendicular to the first
direction, the movable member and the first microactuator being balanced in the first direction
for inhibiting undesirable movement of the movable member in the first direction in response to
externally applied accelerations to the device and the movable member and the second
10 microactuator being balanced in the second direction for inhibiting undesirable movement of the
movable member in the second direction in response to externally applied accelerations to the
device.

29. A device as in Claim 27 wherein each of the first and second microactuators is
an electrically-driven microactuator.

30. A device as in Claim 28 wherein each of the first and second microactuators is
an electrostatic microactuator.

31. A device as in Claim 29 wherein each of the first and second microactuators has
a first comb drive member mounted on the substrate and a second comb drive member overlying
the substrate and movable relative to the first comb drive member.

32. A micromechanical device comprising a substrate, a movable member overlying
the substrate, actuator means carried by the substrate and coupled to the movable member for
moving the movable member in first and second substantially perpendicular directions and
balancing means carried by the substrate and coupled to the actuator means for inhibiting motion
5 of the movable member in response to externally applied accelerations in such directions.

33. A device as in Claim 33 wherein the actuator means includes first and second
microactuators.